Some Assembly Required

LIVE! via satellite
February 18, 1999
12:30 - 2:00 PM (ET)

Educator Materials

Index

Fortieth Anniversary
Pioneering the Future

WHRO

About

The Teleconference

Some Assembly Required

LIVE! February 18, 1999

Overview

The Educator Materials provide background information and activities to be used with the **International Space Station: Some Assembly Required** Teleconference and the coordinating **Student Materials** found in this mailing. This program is designed for middle and high school students to develop an interest in the skills necessary to pursue careers as scientists, engineers, and astronauts.

Provided in the Educator Materials are student activities, vocabulary terms and Internet resources. You may find other activities in your school library or through your NASA Teacher Resource Center. Go to http://spacelink.nasa.gov to find a complete list of Centers.

Please encourage your students to investigate the International Space Station (ISS) through multiple sources. The more students research, the better they'll be prepared to interact with the NASA experts during the Question and Answer segments of the teleconference.

Summary

International Space Station: Some Assembly Required Teleconference is sixth in a series of live and interactive satellite events, targeted to middle and high school students and supports a broad range of educational goals. Students will learn about:

- Collaboration between international scientists, engineers and astronauts
- Careers in math and science

Live and Interactive!

You can **Email** your questions to the teleconference panelists in advance!
From the Teleconference Web Page http://centauri.larc.nasa.gov/station.html
or directly to station@whro.net

DURING THE PROGRAM, **CALL** in your questions at 1-800-966-9106

DURING THE PROGRAM, **FAX** to (757) 423-0617

About

The Teleconference

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Program Schedule

(Designed for use in the classroom, the teleconference is divided into three 30-minute modules.)

Part I. Assembling the People……..……..12:30 PM

- Training for living and working aboard International Space Station (ISS)
- Building a menu for ISS: Astronaut health and nutrition
- Psychological and physical effects of long-duration space flight

BREAK

Part II. Assembling the Parts……..……..1:00 PM

- Advanced computer simulations for ISS assembly
- From the ground to space: redesigning a research laboratory for ISS
- Building hardware for life and research aboard ISS

BREAK

Part III. Making the Connection……..……..1:30 PM

- Effects of microgravity environment on fundamental scientific processes
- Current research that will impact health and environmental issues
- New technology for transmission of scientific data from Space Station to Earth

CONCLUSION……..2:00 PM

Teleconference Host

Philip West made kids across the country laugh with his quirky spacesuit demonstration last year. Phil has been an engineer of spacewalk gear at NASA for over 10 years. Phil lead the team that designed the tools the astronauts are using to assemble and repair the International Space Station.

Studio Panelists

Kathryn Clark is the senior scientist for the International Space Station. As senior scientist, Dr. Clark coordinates the national and international research communities. She serves on the NASA committees responsible for the oversight of the International Space Station. Dr. Clark is a professor at the University of Michigan.

Lawrence DeLucas is a former astronaut who flew his experiments on a 1992 Space Shuttle mission. Director of a research center at the University of Alabama, Dr. DeLucas performs research with special interest in protein crystal growth.

Including a special appearance by a NASA Astronaut!

About

International Space Station

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Background Information

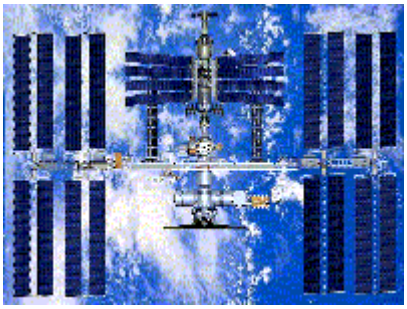
The International Space Station (ISS) is an unprecedented undertaking in scientific, technological and international experimentation that will bring enduring benefits for life on Earth and in space. Collaboration among our international, industrial and academic partners will ensure that the benefits from ISS work are felt across the global spectrum of public and private interests.

The International Space Station will provide an orbital laboratory for long-term research, where one of the fundamental forces of nature -- gravity -- is a variable. In addition, worldwide research in biology, chemistry, physics, ecology and medicine can be conducted using the most modern tools available. The study of the states of matter and their interactions in microgravity provides an exciting opportunity to expand the frontiers of science.

The governments of the United States, Canada, Europe, Japan, Russia and Brazil are collaborating with their commercial, academic and other international affiliates in the design, operation and utilization of the ISS. As our astronauts and Earth-bound researchers act as space operators and investigators, they will generate a wealth of knowledge that we will apply in the fields of commerce, science, engineering, education and space exploration.

VOCABULARY TERMS

BLOOD PRESSURE	the pressure of the blood on the walls of the arteries
COGNITION	the process and ability of knowing and understanding
CARDIOVASCULAR	related to the heart and fluid circulation
EXTRAVEHICULAR ACTIVITY (EVA)	human trips outside of a spacecraft, also known as spacewalks
EXTRAVEHICULAR MOBILITY UNIT (EMU)	space suit with life support systems
GRAVITY	the attraction of objects to one another due to their mass
HEADWARD SHIFT	the flow of fluids to the upper portions of the body due to lack of gravity
MODEL	in science a model is a creation or description which attempts to simulate and/or understand a true relationship in nature. A model is rarely without faults in its attempt to describe the true process and arrangement in nature
MICROGRAVITY	an environment in which the apparent weight of an object is small compared to that object's actual weight under the effects of gravity
NEUTRAL BUOYANCY LABORATORY (NBL)	underwater training facility for astronauts
NUTRITION	the process by which an animal or plant takes in and utilizes food substances
OZONE	a bluish gas made of 3 oxygen atoms that is formed naturally in the upper atmosphere



Questions
Start Your Students Thinking About International Space Station

These questions should be used to develop an interest prior to the **Some Assembly Required** Teleconference. The Teleconference may help to answer some of these questions:

Q Did you know that when astronauts first experience microgravity they look different? In fact, they develop "puffy face" where their face swells up. Can you guess why?

A Body fluids make a "head-ward shift" which means they move to the upper portions of the body due to the lack of gravity. The lack of fluids in their lower body causes an appearance called "bird legs".

Q How would you season your steak in space if salt and pepper would float around the cabin when poured?

A Salt and pepper are packaged in liquid form and spread on food.

Discussion

Generate a discussion and have students form hypotheses to the following questions. Challenge them to confirm their hypotheses through independent research.

- How is the human body affected by the space environment and what is needed to keep astronauts safe and healthy? Understanding this may lead to treatments for such human diseases as osteoporosis and heart disease.
- How do fluids behave on the Earth and in microgravity? What effects does microgravity have on the cardiovascular system? Understanding this may help us understand how the body works and lead to new terrestrial and space-based technologies.
- What role does gravity play in the growth and development of plants and animals? How do living things sense and respond to gravity at the molecular, genetic and cellular levels?
- How can cell and tissue culturing be improved in microgravity and how can we extend that to work here on Earth? Understanding this may lead to the development of replacement cell and tissue therapies to help treat diseases.
- How does mission control communicate with the astronauts in space? How will the data collected during the mission be sent to Earth?

CLASSROOM PROJECT
Let's ASSEMBLE a Space Station!

Overview

What is it like to work on a multi-component, multi-national project such as International Space Station? This project will get students thinking about the collaboration that takes place between the International Space Station scientists, astronauts and engineers as they assemble the largest orbiting research facility –the International Space Station.

Before the Teleconference

Brainstorming / Class Discussion

Engineers, scientists and astronauts from 16 nations around the world have been working together on the ISS project.

- *What role might an engineer have in the design and construction of the ISS?*
- *What role does a scientist have in preparing for the experiments in space?*
- *What do astronauts do in space?*
- *How will language and cultural differences affect life aboard the ISS?*

Class Activity

Have your students investigate the culture and language of each ISS partner, as well as the contributions they will make to ISS.

Brainstorming / Class Discussion

ISS astronauts must train for one year for a mission. They will learn to perform spacewalks and assemble the ISS. They will also have language training and work with engineers and scientists in order to learn skills necessary to perform tasks.

- *What type of training is involved in preparation for a long mission in space?*
- *How will they communicate with their families? How is data collected and sent back to Earth?*

Class Activity

Have students search the Internet and newspapers to find out how ISS astronauts are currently training; updates on ISS assembly; and the technology ISS will have to communicate with Earth.

Culminating Activity

When the research and classroom activities are complete, have student groups compile questions that they would like NASA's ISS experts to answer during the teleconference. Have each group report their list of questions to the class. Other groups may have found the answers to their classmates' questions. Have students nominate questions to be emailed, faxed or called in to the teleconference. The questions just might be answered on the air!

Class Activity

Divide students into groups of three people -- “engineers”; “astronauts” and “scientists” -- and provide each with an individual task card. These task cards will direct students to become familiar with general background knowledge related to their job description. On the task card are questions that relate to the program and should guide student research. Students should report back to the class their findings. (Some of the questions may be answered in the teleconference.)

Student Task Cards

Engineer Task Card

Your responsibility is to investigate the design and construction of ISS components that will support astronauts living and working in space. Think about what materials you will need, and work with scientists and astronauts to determine priorities of power, life support and other requirements. Report on what international partners are currently doing to prepare for ISS.

- What does it take to become an engineer for the ISS?
- How are ISS engineers currently training for the missions?
- What role might you play in how meals are determined for Space Station?

Internet Resources
Space Station Home Page
http://station.nasa.gov/index-m.html

Astronaut Task Card

Your responsibility is to become an expert on microgravity and work with scientists and engineers to coordinate how your duties will be completed in the space environment. Your job may include scientific experiments, performing upgrades on the station or computer software, or keeping track of your health. Report on training for spacewalks, countermeasures for staying healthy, and collaboration with international partners.

- What does it take to become an astronaut for the ISS?
- How are ISS astronauts currently training for their missions?
- What are some of the psychological effects of prolonged periods of time in space?
- What role might you play in how meals are determined for Space Station?
- What effects does microgravity have on the body?

Internet Resources:
Space Station Crew
http://station.nasa.gov/station/crew/index.html

Scientist Task Card

Your responsibility is to investigate the types of research proposed for the Space Station. Report on how microgravity will benefit this research, and how this research will benefit life on earth. Work with engineers and astronauts to investigate how research will be conducted differently on ISS, considering weight, size, and power restrictions, as well as, the human interaction required.

- What does it take to become a scientist for the ISS?
- How are ISS scientists currently planning for the missions?
- What role might you play in how meals are determined for Space Station?
- What effects does microgravity have on the body?

Internet Resources:
Space Station Science
http://station.nasa.gov/station/science/index.html

Classroom Activities

(These activities are designed to reflect the themes of the teleconference.)

Activity # 1

(For Part 1 of the Teleconference)

Cardiovascular: Heads Up, Heads Down?

Overview

What do lying in bed and living in space have in common? That's what researchers for NASA's Life and Microgravity Sciences are trying to find out. By restricting their test subjects to 17 days of head down tilted bed rest, NASA scientists hope to simulate the fluid shift that occurs in the body of astronauts in microgravity. In the students' tests, subjects lying with their feet up likewise cause the blood pressure in their head to increase, also simulating the condition of microgravity.

Key Questions

- Does lying down with your feet up affect your normal cognitive abilities?
- How do NASA scientists design Earth-based experiments to simulate the conditions of space flight?
- How do the results of the head down bed rest experiments compare with test results from astronauts in space flight?

For the full activity see:
http://stellar.arc.nasa.gov/stellar/Activities/Activities.html

Activity # 2

(For Part 1 of the Teleconference)

What's for Dinner?

Have students investigate the effects microgravity has on eating in space.

Procedure

Brainstorm with the class a list of kitchen tools used to prepare food. Have students make a list of all the food items in their favorite meal. Have them write an **S** next to the foods that are a solid and an **L** next to the foods that are a liquid. Then have students write specific directions on how to prepare the food listing every tool or instrument needed. Ask students to describe how this procedure must change if they would like to have it prepared in space. Have the students draw one solution or piece of equipment needed to prepare it in space. Have students describe the preparation to the class. Ask students to describe foods from different cultures and how it may require different preparations.

Activity # 3
(for Part 2 of the Teleconference)

Building a closed environment

Overview

We must understand the interdependent relationships between photosynthesis and animal respiration before we can proceed in developing systems that will allow long term survival in space. Utilizing the processes of photosynthesis and respiration, students investigate living organisms in a closed environment.

Key Questions

- What factors are necessary in order to assure that living things can survive and function in a closed environment?
- What happens to plants when they are placed in an environment saturated with carbon dioxide for a period of time?

For the full activity see:
Investigating Plants in Space at http://spacelink.nasa.gov/

Activity # 4
(for Part 3 of the Teleconference)

How do crystals grow in space?

Have students investigate why researchers will grow protein crystals on ISS. Have them grow their own crystals and think about how the microgravity environment might change how they do the experiment.

Materials

250 milliliters of warm water	spoon
two drinking glasses	salt
fifteen-centimeter piece of string	pencil

Procedure

Pour the 250 milliliters of warm water into a glass. Put some salt into the warm water. Stir until the salt dissolves. Add salt until no more will dissolve. (Some undissolved salt will remain at the bottom of the glass.) Now pour the clear water into another glass. (Leave the undissolved salt in the first glass.) Tie a piece of string around the pencil. Lay the pencil across the top of the glass. The string should hang down into the water. Place the glass in a protected place. Check weekly. How long does it take for the first crystals to form? Check daily. What do you observe?

During the Teleconference

Focus on how the program connects and approaches tasks on the Space Station. Have students focus on how the duties of an astronaut, engineer and scientist overlap and how collaboration is illustrated throughout the teleconference.

After the Teleconference

A. Discuss with students how their ideas have changed since they first researched the roles of astronauts, engineers and scientists.

B. Bring your classroom project to life by transforming the classroom into a "Simulated Space Station" with identified workstations. Search the Internet and library for pictures of the International Space Station. Include designs of space stations from the past and future. Remind students that the Space Station must accommodate astronauts living and working in space (astronauts need to perform experiments, eat, sleep and exercise) while keeping in mind cultural and language differences.

C. Have students share information they learned before and during the teleconference, focusing on the role assigned to them prior to the live event, as an astronaut, scientist or engineer.

- Have students define their roles and ISS job tasks.
- Have students report on current ISS events related to their role.
- Have students write about how their job tasks on ISS may help improve life on earth.

Keep in mind that ISS crewmembers must perform many duties. Have students investigate multiple tasks. For example, an astronaut's tasks may include doing scientific experiments, performing resistance exercises, or making repairs to the ISS.

Collaboration between the astronauts in space with the engineers and scientists on Earth is essential for a successful long-term project. Have students report on collaborative tasks, for example, how will scientists train astronauts to perform their experiments? How will engineers from many nations collaborate on designing compatible hardware for the ISS?

D. Divide students into teams.

1. The first team, representing astronauts, scientists, and engineers will report on their findings in front of "ISS executives" to gain continuing financial support for the Space Station Project. Based on their tasks, have them prioritize their needs (scientific equipment, robotics for assembly, food/supplies for astronauts) and present these requirements to the executives. Have the executives compile this information with the research they've already done and decide which requests will be granted.
2. The executives will compile the above information and present their plan to the "national funding agency". Have the national funding agency compile this information and make decisions about what requests will be denied or granted.
3. The national funding agency will then report to the "international partners" their requirements and planned support for the ISS Project. The national funding agency should request additional resources from the international partners.
4. The international partners will present research on each nation's resources and make final recommendations for the International Space Station project.

Internet

Resources

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LIVE! February 18, 1999

Visit the International Space Station Teleconference Web Page at
http://centauri.larc.nasa.gov/station.html

The Official International Space Station Home Page
http://station.nasa.gov/index-m.html

Educational Resources for the Classroom!

Aeronautics and Space Resources for Educators
http://spacelink.nasa.gov/.index.html OR http://spacelink.nasa.gov/Educational.Services/

NASA HQ Educational Resources
http://www.hq.nasa.gov/office/olmsa/edu/index.htm

The STELLAR Program – Great Ideas for Classroom Activities
http://weboflife.arc.nasa.gov/stellar/index.html

Check out these Classroom Projects!

BioBLAST -- Better Learning through Adventure, Simulation, and Technology
http://www.cotf.edu/BioBLAST/

EarthKam -- Interactive Technology for Earth Observations
http://www.earthkam.ucsd.edu/

Watch for Other Space Activities in Your Community!

National Engineers Week – Brings Engineering to the Classroom
http://www.eweek.org/

Spaceweek – Dedicated to Thinking and Learning about Space
http://www.spaceweek.org

Star Station One -- Boeing Brings ISS to Your Museum
http://www.bishop.hawaii.org/starstation/index.html

ATTENTION!

We value your comments! Please fill out this Educator Evaluation Form and return immediately to: WHRO Center for Public Telecommunications (ISS), 5200 Hampton Boulevard, Norfolk, Virginia, USA 23508. Or submit your Evaluation electronically at: http://ehb2.gsfc.nasa.gov/edcats/iss_educators.html

** Privacy Act Authorization **

The Government Performance and Results Act of 1993 requires that all Federal Agencies or Departments provide an annual evaluation of all programs in order to improve program effectiveness and public accountability. Disclosure of the information requested is voluntary. The information collected will be used to improve program delivery, and to compile the required annual report. Routine use of the information may be used to carry out follow-up evaluations to provide you with further information about similar programs. Personal information will not be released to any external organization unless express authorization is requested and provided. There is no effect to you, the participant, if you elect not to complete any or all of the information requested on this form.

Educator Evaluation Form

International Space Station: Some Assembly Required
February 18, 1999
12:30-2:00pm ET

I. Participant Identification

Last Name:_____ First Name:_____ Middle Initial:_____
Name of Institution: _____
Street Address: _____
_____
City:_____ State: _____
Country: _____ Zip / Postal Code:_____
Phone Number with Area Code:_____
Fax Number with Area Code:_____
Email Address:_____

II. Space Station Teleconference

I viewed the teleconference: (check all that apply)

- Live on February 18, 1999
- Via videotape at a later time

Number of others who viewed with me on February 18, 1999 _____
Number of times in the next year that I will use videotape, or portions of it _____
Estimate number of other viewers of videotape over the next year _____

I consider the quality of the program as:

- Excellent
- Good
- Average
- Poor
- Very Poor

The program content is useful in my learning environment:

- Yes
- No

Favorite part of the program:_____
_____
_____
Least effective part of the program:_____
_____
_____

General Comments:_____
_____
_____

The supporting materials are useful in my learning environment:

Educator Materials	Student Materials
Yes	Yes
No	No

III. Viewing Site:

I teach the following grade level(s): (Mark as many as apply)

___ K ___1 ___2 ___3 ___4 ___5 ___6 ___7 ___8 ___9

___10 ___11 ___12 ___ College Level ___General Public

Primary Areas of Instruction: (Mark all that apply)

All Subjects
Astronomy
Biology
Chemistry
Physics
Mathematics
Earth Sciences
General Science
Life Sciences
Physical Sciences
Other Please specify _____

Please add my name to future mailings on this and related subjects:

Yes
No

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Phone: (440) 774-1051 FAX: (440) 774-2144
Email: nasaco@leeca.esu.k12.oh.us
Web Site: http://spacelink.nasa.gov/CORE